

10/673,613

Page 7

LISTING OF CLAIMS

1. (previously presented) A method for improving the performance of a golf club, comprising the steps of:

fabricating a golf club head having a face;

friction stir processing a predetermined metallic region of the surface of the golf club face, thereby creating a local fine grained microstructure in the region without significantly affecting the mechanical properties of other portions of the head; and

resurfacing at least the predetermined region subjected to friction stir processing so as to provide a desired surface topology.

2. (original) The method of Claim 1, wherein the golf club head comprises a metal selected from the group consisting of aluminum, titanium, nickel, copper, iron, and alloys thereof.

3. (original) The method of Claim 1, wherein said step of fabricating includes a step of casting or forging.

4. (original) The method of Claim 1, wherein said step of friction stir processing is performed using a FSP tool rotating at a rate between 150 and 2000 rotations per minute.

5. (original) The method of Claim 1, wherein said step of friction stir processing is performed using a FSP tool moved along the workpiece surface at a rate of 50 to 7000 mm/minute.

6. (original) The method of Claim 1, wherein said step of re-surfacing includes a step of milling.

10/673,613

Page 8

7. (original) The method of Claim 1, wherein the desired surface topology includes at least one groove.

8. (previously presented) A method for improving the performance of a golf club, comprising the steps of:

friction stir processing a predetermined region of the surface of a metallic workpiece, thereby creating a local fine grained microstructure in the region without significantly affecting the mechanical properties of other portions of the workpiece; and
fabricating a golf club head having a face which includes the predetermined region.

9. (original) The method of Claim 8, wherein the metallic workpiece comprises a metal selected from the group consisting of aluminum, titanium, nickel, copper, iron, and alloys thereof.

10. (original) The method of Claim 8, wherein the metallic workpiece has a shape selected from the group consisting of strip, plate and block.

11. (original) The method of Claim 8, wherein said step of fabricating includes a step of forging.

12. (original) The method of Claim 8, wherein said step of friction stir processing is performed using a FSP tool rotating at a rate between 150 and 2000 rotations per minute.

13. (original) The method of Claim 8, wherein said step of friction stir processing is performed using a FSP tool moved along the workpiece surface at a rate of 50 to 7000 mm/minute.

10/673,613

Page 9

14. (original) The method of Claim 8, further comprising the step of:
re-surfacing at least the predetermined area subjected to friction stir processing so
as to provide a desired surface topology.

15. (canceled)

16. (canceled)

17. (original) The method of Claim 14, wherein the desired surface topology includes
at least one groove.

18. (previously presented) A golf club head with improved performance, including a
face having a surface for contacting a golf ball, wherein the improvement comprises:

a friction stir processed metallic region of the face surface having, by virtue of the
friction stir processing, a local fine grained microstructure whose mechanical properties
are distinct from the mechanical properties of other portions of the head.

19. (previously presented) The golf club head of Claim 18, wherein said friction stir
processed metallic region is selected from the group consisting of aluminum, titanium, nickel,
copper, iron, and alloys thereof.

20. (previously presented) The golf club head of Claim 18, wherein the friction stir
processed metallic region is harder than the other portions of the head.

21. (previously presented) The golf club head of Claim 18, wherein the friction stir
processed metallic region exhibits fewer voids and defects than the other portions of the head.

10/673,613

Page 10

22. (previously presented) The golf club head of Claim 18, wherein the friction stir processed metallic region is more resistant to wear than the other portions of the head.

23. (previously presented) The golf club head of Claim 18, wherein the friction stir processed metallic region is no more than 3 mm thick.

24. (previously presented) The golf club head of Claim 18, wherein the friction stir processed metallic region substantially corresponds to the sweet spot for the head.

25. (previously presented) The golf club head of Claim 24, wherein the tendency for wear on the face to be reduced in the sweet spot, relative to other portions of the face, provides a long term indicator of a golfer's performance.

10/673,613

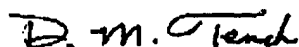
Page 11

CONCLUSIONS

The arguments presented here show that friction stir processing (FSP) is distinct from friction stir welding (FSW), and has been considered to be patentably so by the U.S. Patent and Trademark Office. The present inventor was the first to recognize that FSP could be used to impart hardness and strength to the sweet spot of a golf club face while maintaining ease of fabrication and avoiding inserts or attachments that would reduce golfing performance. The invention fulfills a long-standing need that has persisted despite the availability of the friction stir processing method for several years. The principal art cited by the examiner actually teaches away from the invention. For example, the combination of Anderson and Thomas teach that a forged metallic plate should be attached to the golf club face by friction stir welding along the perimeter of the plate. In this case, any improvement in material properties provided by the friction stir welding would provide no benefit since the weld joint lies outside the sweet spot. In addition, much of the benefit derived from the harder material in an attached plate would be offset by losses associated with energy transfer across the interface between the plate and the club head. The present invention circumvents these deficiencies by providing material of enhanced hardness and strength as an integral part of the club head at the sweet spot of the face.

In consideration of the arguments presented, it is respectfully requested that all of the claims, as amended, be allowed.

Respectfully submitted,



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